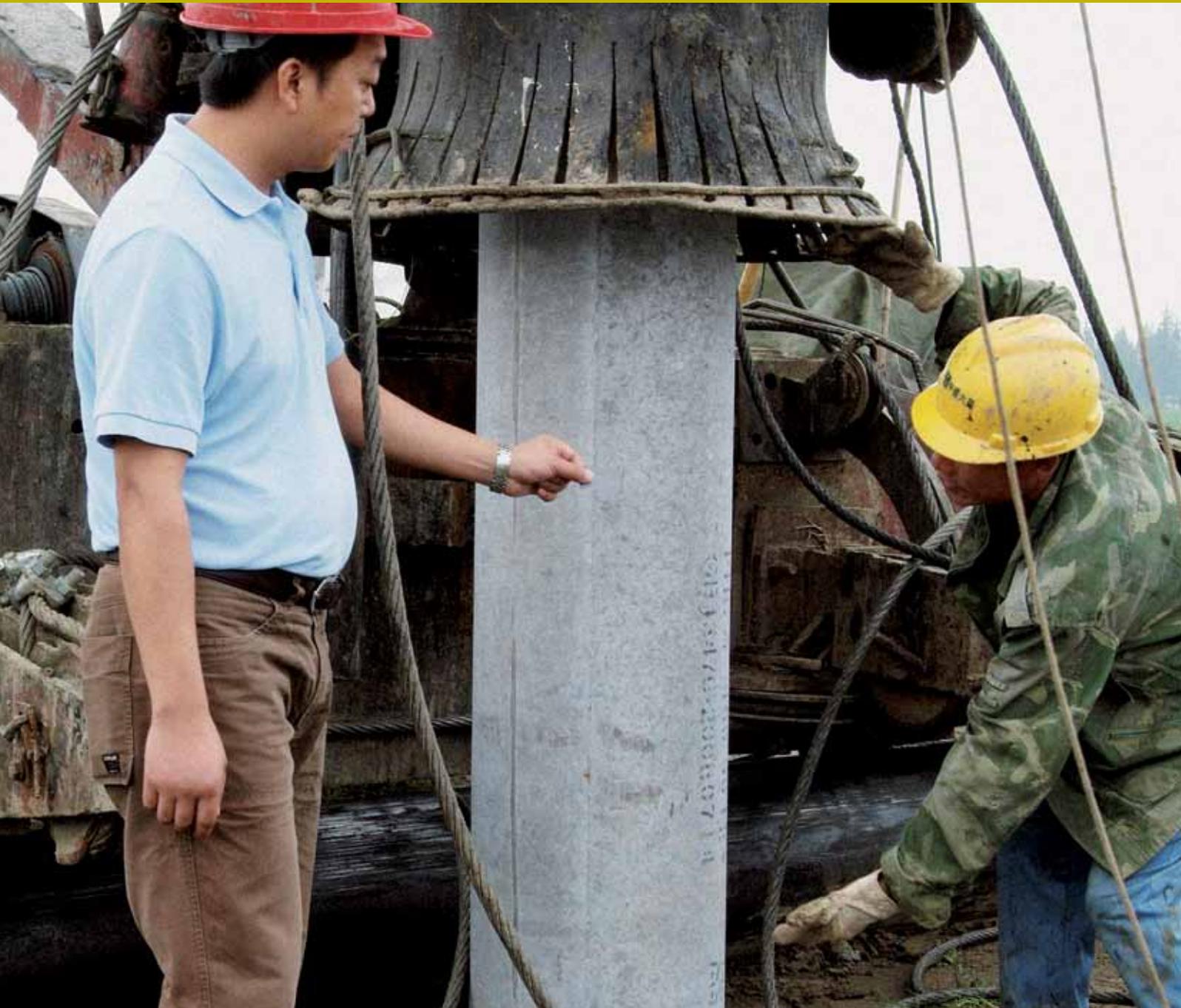


Dramix®

 **BEKAERT**

better together

Benefit from Dramix® high impact piles



An ideal solution for ground conditions along China's east coast

Pile foundations are used to support tall buildings and various types of public works. As is the case with most foundation works, product quality and safety are of utmost importance here. However, constructing with traditionally reinforced pile foundations can be a real challenge, especially in extreme conditions where grounds are hardly penetrable. Hitching piles in such bad environments often results in broken or severely damaged pile materials.



Traditional pile foundations can suffer severe damage in extreme ground conditions

More and more, pile constructors and installers are choosing to reinforce their pileheads with Dramix® steel fibres. The reason is obvious. No other reinforcement solution provides this level of reliability, durability and cost-efficiency.

One area that is renowned for its stubborn grounds is China's east coast. Local Chinese constructors, investors and designers are therefore increasingly looking for reliable foundation solutions that can stand up against these tough ground challenges. For them, pileheads reinforced with Bekaert's Dramix® steel fibres hold a promising solution for future developments.



High-impact reinforcement: Insights of an engineering expert

“In modern pile foundations, we increasingly choose to add Dramix® steel fibres to the pile heads in order to increase impact resistance.”



Professor Jiang Yuanhai, Jiaxing University,
Vice president pile association

Professor Jiang Yuanhai is an engineering specialist focusing on pile production and installation. He is also the first draftsman of the China Concrete Piles Standard and the previous director of the China Concrete Piles Association. For him, good quality performance and stable safety are of utmost importance for pile foundations.

Stringent quality requirements

“Three important aspects define the development of steel fibre reinforced piles,” comments Professor Yuanhai. “First of all, we need to select good performance and stable quality fibres, from experienced fibre producers that have the technology to support pile manufacturers in the most optimal way.

Second, mixing fibres with concrete is critical for the production of high-performance piles. We need a solution that is qualitative and therefore successfully avoids fibre balling. Also, we need an economical solution that allows pile producers to save costs by using the lowest possible fibre dosage.

Finally, pile producers and fibre manufacturers need to collectively set up a quality control system in order to obtain the most optimal pile performance.”

Increasing impact resistance with Dramix® steel fibres

Pileheads reinforced with Dramix® steel fibres are a successful alternative for traditionally reinforced pileheads, which more often than not suffer from bad quality and broken materials. “Especially with solid sand or hard clay grounds, where usually P_s exceeds 20, traditional mesh reinforcement results in serious difficulties,” explains Professor Yuanhai. “In such environments, the hitch number increases and passes the maximum allowable for Pre-stressed High Concrete (PHC) piles. Cost-wise, steel piles are not an option. Therefore, in modern pile foundations, we increasingly choose to add Dramix® steel fibres to the pileheads in order to increase impact resistance.”

Setting the standard

The graduate school of pile application at Jiaxing University is the first department focusing on pile foundation. “We greatly appreciate Bekaert as a partner in the promotion of steel fibre reinforcement for pilehead applications in PHC,” says Professor Yuanhai. “We hope to accumulate valuable engineering experiences so we can contribute to the creation of a new industry standard.”



Dramix® Green for rustfree surfaces

Dramix® steel fibre reinforcement in Sea environment

Dramix® Green is Bekaerts zinc coated fibre which ensures rust free surfaces. Dramix® Green products are extremely durable; they are products of choice to create long-lasting solutions, where long-term durability, rust-free or esthetic surfaces are a must. They are specially engineered to enhance performance even in ‘Chrome-free cements’.

Cost-efficiency meets quality: Insights of a production expert

“With Bekaert’s Dramix® steel fibres, we were able to work with extremely low dosages and still meet all quality requirements.”



Mr. Chen Jianhong, at SPECL-PB



“Stable fibre quality in line with the standards and high-level support on how to handle and mix steel fibre concrete. Bekaert offers the total package, which for us is the only way to succeed in pilehead construction,” explains Mr. Chen Jianhong. “By adding Bekaert’s Dramix® steel fibre to the pileheads, we can offer pile installers a reliable product, which allows them to work fast and avoid excessive costs due to high fall-out figures.”

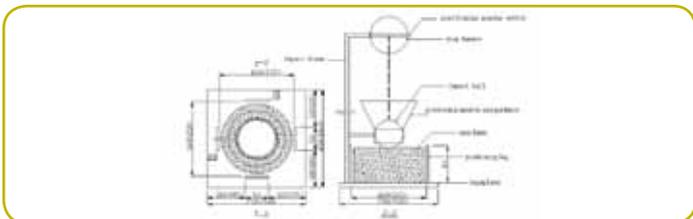
“Bekaert also offers us extensive engineering services, which directly translate into cost savings. Thanks to scrupulous calculations, we are able to work with extremely low Dramix® dosages and still meet all quality requirements:

Together with Bekaert, we define the optimal fibre type and dosage:

- ① The minimum total fibre length for improved impact resistance is 1000 m³

fibre length	dosage	fibre type	fibres/kg	fibre length (mm)	fibre diameter (mm)
10150 meter wire/m ³	20 kg/m ³	RC-65/35-BN	14500	35	0,55
5600 meter wire/m ³	40 kg/m ³	50/1.00	2800	50	1,00

This total fibre length ensures the minimum network affect to provide a specific multicrack process.



Steel annulus control drop-weight test equipment (unit: mm)

② “We developed an easy, standardized impact test, which enables us to monitor the **impact improvement** by adding fibres in our pile heads. We scanned various fibre types and dosages for to the most optimal and economical result.”



③ Short glued fibres are clearly the fibres of choice to reach homogenous reinforcement without fibre blocking between the rebars.

“With Dramix® reinforced concrete, we can offer our customers high-quality piles for extreme ground conditions. Adding Dramix® means reducing the number of broken piles. Therefore, working with Dramix® reinforced concrete gives us an economical advantage.”

Successfully reducing fall-out: Insights of a installation expert



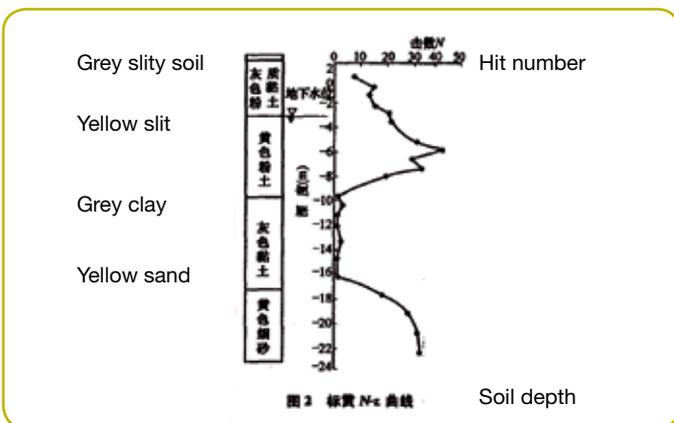
Mr. Chen Zhi Wen

“Due to cost reasons, steel piles are no longer an option nowadays. That is why constructors and installers are increasingly looking for new pile foundation concepts,” explains Mr. Cheng Zhi Wen, from Shanghai Port Engineering Company. “When ground conditions are difficult, for example with solid sand or clay ground, the number of hitches needed to successfully drive a pile into the ground is increasing. Proportionate to the number of hitches, the chance of pile damage - and associated cost consequences - is increasing.”

Both the ground conditions and the total pile length are good indicators of the total number of hitches we need to drive a pile into the ground. There are three ways to estimate the number of hitches required:

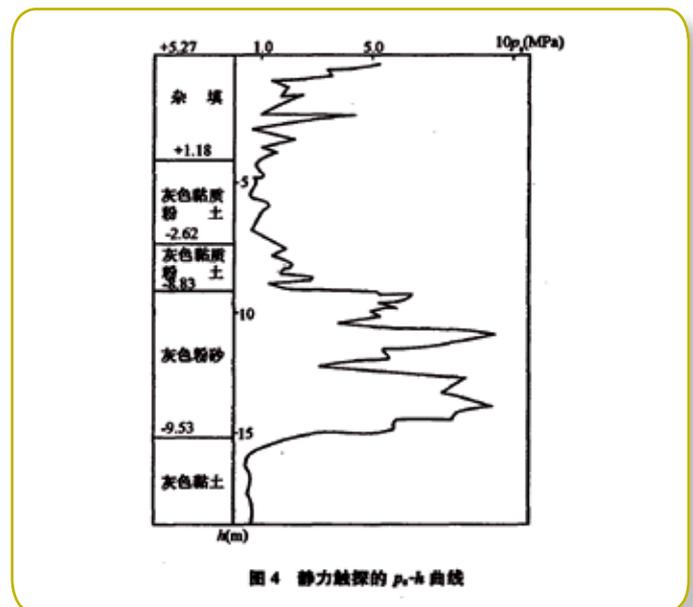
1 The standard penetration test:

When N is greater than 50, then we choose for Dramix® steel fibre reinforced piles. This test is developed to determine the soil friction by counting how many hits (N) are needed to hit a penetrator into soil 300 mm deep. Get the soil physical mechanical property after analysis a big amount of test data. The graph is to describe the relationship between soil depth and its corresponding penetration hits.



2 The static penetration test:

When PS > 20 we need a large number of hitches.



3 Experience which learned us:

Nr of hitches needed	Preferred pile solution
Max 1000	Normal concrete piles
Max 2000	Pre-stressed piles
Max 3000	PHC piles
More than 3000	PHC Dramix® piles or steel piles

“A test was launched with Bekaert where we added fibres to the top of the pile. However, on that specific test site, a worker happened to misplace the top part with fibres on the bottom side. So consequently, we hitched an amount of piles on the top part, and another amount of piles on the bottom part. The number of broken piles was very different between the two batches. We immediately noticed the real impact of adding fibres to the reinforced concrete. Since then, a new solution was created and expanded into different projects.”

In a nutshell:

The addition of Dramix® steel fibres to traditional reinforcement products (rebar) is a powerful and technically feasible solution that:

- increases impact resistance
- reduces fall-out
- speeds up project execution
- decreases operational cost

Other Dramix® applications:

- Industrial flooring
- Pavements
- Tunneling projects



Bekaert SBE in Shanghai,
the n°1 Chinese steel fibre producer

What can Bekaert do for you?

- We organize extensive testing to define impact control
- We assist you in handling, mixing and dosing of the steel fibre concrete
- We provide technical support for specialized projects

CONTACT US

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